Omaha Public Power District (OPPD) uses Nalco technology to reduce water withdrawal from the Missouri River by 290 million gallons per year

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CASE STUDY - POWER

CH-1430

BACKGROUND

Drought, high temperatures and falling water levels

Drought conditions and temperatures on the High Plains were extreme in 2012. According to the National Drought Mitigation Center – an organization that compiles and reports data regarding drought conditions across the United States – Nebraska is experiencing some of the most intense drought conditions since record-keeping started in the 1930's.

Electricity demand increases during the hot summer months. In east and southeast Nebraska, that demand is met by the customer-owned Omaha Public Power District (OPPD).

OPPD's Nebraska City generating station, a 1,390 MW coal-fired utility located on the Missouri River, draws roughly 10 million gallons of water every day from the river. Extreme drought placed more stress on the Missouri River system. To compensate, the U.S. Army Corps of Engineers released water from reservoirs in Montana and North Dakota to keep the river levels high enough to allow navigation and water withdrawals for irrigation.

Since 1979, OPPD's Nebraska City Station has been meeting the electricity needs of the region, first, with Unit 1 (1979), and now, with additional power from Unit 2 (2009). Today, OPPD serves 352,000 Nebraskans in 13 counties. In the summer of 2012, under the most stressful conditions in recorded history, it looked like Unit 2 might not be able to meet that need.

SITUATION

On July 22, 2012, temperatures in the Omaha area reached 105°F (41°C). Electricity demand was high. At this most critical time, problems with the plant's raw water clarifiers reduced their make-up water production capacity by 400 gpm. Without that water, the plant could not maintain peak production. Chemical Supervisor Ron Osovski called his Nalco Sales Engineer, Terry Peck, at home on that Sunday. "We've lost some flow to the clarifiers," he said. "We're going to have to derate the plant."

Environmental Indicators	eROI	Economic Results
Reduced water withdrawals from the Missouri River by 290 million gallons per year	WATER	Reduced clarification costs by $29,000/year

Nalco reports eROI values to customers to account for contributions in delivering both environmental performance and financial payback.

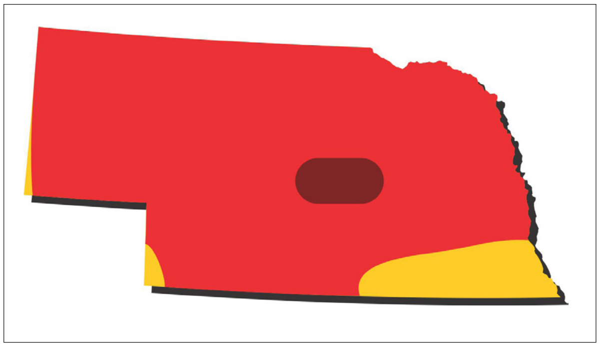

Figure 1 – *According to the National Drought Mitigation Center, drought conditions in most of Nebraska have been Severe (yellow), Extreme (Red) or Exceptional (brown) in 2012.*

"Derate" refers to a condition in which the plant must operate below (or cannot operate at) its design capacity due to an operational failure or problem. When a power plant cannot reach its capacity, other power plants must pick up the load. In the case of a merchant power plant, revenue that could have been generated is lost. In the case of a customer-owned utility, it means the consumers pay more for their electricity. No one wins when a power plant can't meet its capacity and availability goals.

"We're not going to let that happen," Terry said. Terry and Ron had been discussing ways to reduce water usage in their cooling tower system for some time. In fact, earlier in the year, they'd made changes in the cooling water system that resulted in water use reductions. The changes required in July 2012 took those efforts to a whole new level.

Plans involved using the Nalco 3D TRASAR Cooling Water Optimizer to model different chemical feed, control and monitoring strategies. Working together, they'd determined that the plant could safely increase cooling tower cycles of concentration and reduce the amount of make-up water required. That would reduce the load on the clarifiers and allow them to keep running at capacity. During a meeting at the plant, those recommendations were reviewed by the plant operating staff and the decision was made to implement them permanently.

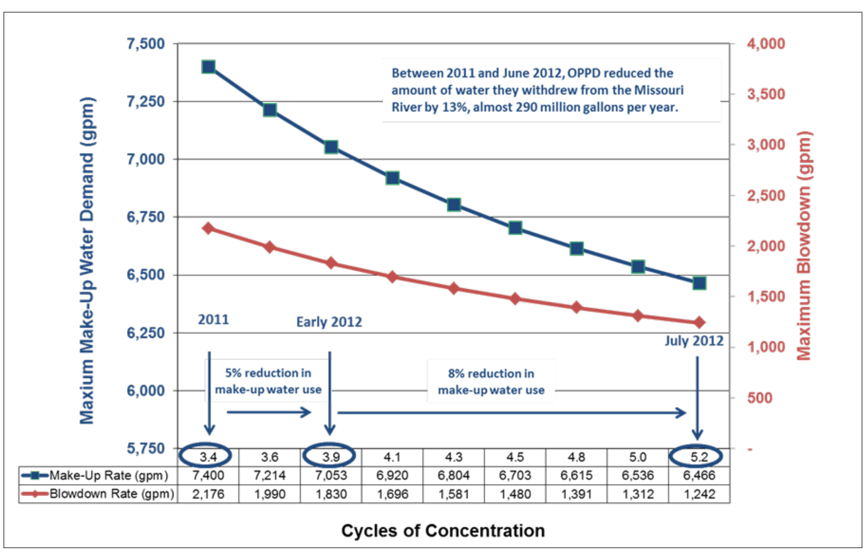

Figure 2 – *Increasing cycles of concentration reduces make-up water use. In this case increasing cycles from 3.4 to 5.2 resulted in a water use reduction of 806,400 gallons per day*

PROGRAM

Crisis averted and long-term improvements achieved

Increasing cooling water cycles presents risk. If blowdown is reduced too much, mineral scale and fouling occurs, causing long-term losses of efficiency and increased costs. The decision to increase the scale-forming stress on a cooling system must be based on science, not guess-work.

The 3D TRASAR Cooling Water Optimizer is a sophisticated solubility modeling tool. It combines scale and corrosion modeling with the ability to account for mechanical and operational factors that affect cooling water system performance. Other measures of the scale forming or corrosive tendency of a water – like the Ryznar Stability Index – are limited in their scope, predicting, as an example, calcium solubility over a range of pH and temperature conditions. The 3D TRASAR Cooling Water Optimizer predicts the solubility of every mineral species present in the cooling water and the potential for scale, corrosion or fouling under the actual mechanical and operational conditions existing in the cooling system.

In this case, the 3D TRASAR Cooling Water Optimizer predicted that the conductivity in the recirculating water could be increased from 2,700 µmhos to 4,250 µmhos, increasing the cooling tower cycles of concentration from about 3.4 to 5.2. The result: a reduction in make-up usage of 400 gpm, which would reduce the load on the clarifiers by 13%, more than enough to allow the plant to operate at peak capacity.

RESULTS

Reducing the make-up water demand on the clarifiers allowed the plant to continue running, without the derate, even under the most demanding conditions. This was more than a simple crisis averted. The solution was permanent. The plant has seen no evidence of scaling or fouling and has maintained the lower make-up water usage rate, reducing their water usage by over 290 million gallons per year. Reduced water use also reduced their clarification and sludge disposal costs.

Reducing cooling tower blowdown saves chemicals, too. Less aluminum chlorohydrate and polymer are needed for making water and less scale inhibitor is lost in the blowdown. This reduction is expected to save $29,000 annually when compared to average blowdown rates in 2011.

Sludge generated by the clarifiers is sent to local landfills. Reducing the load on the clarifiers reduced the amount of sludge generated, reducing disposal costs and the amount of material delivered to the landfills.

Every power plant wants to be a good corporate citizen of the community in which it operates. Every power plant wants to minimize its environmental impact. Those desires must be balanced with the needs of the community for reliable, low-cost power.

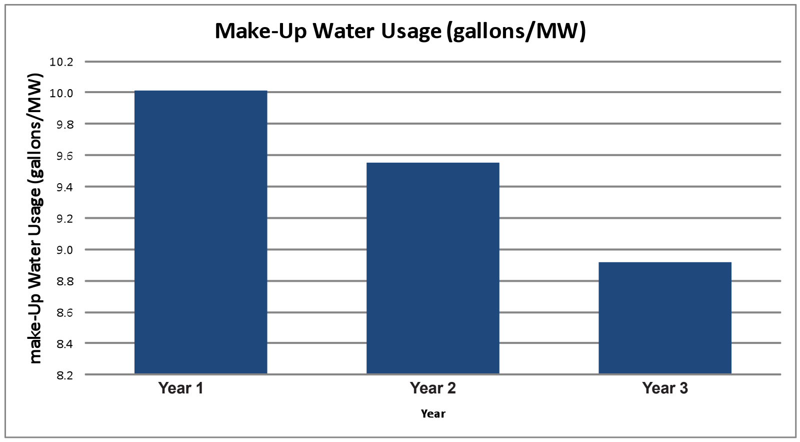

Figure 3 – *Water withdrawals from the Missouri River were reduced by 290 million gallons per year by increasing cooling water cycles of concentration.*

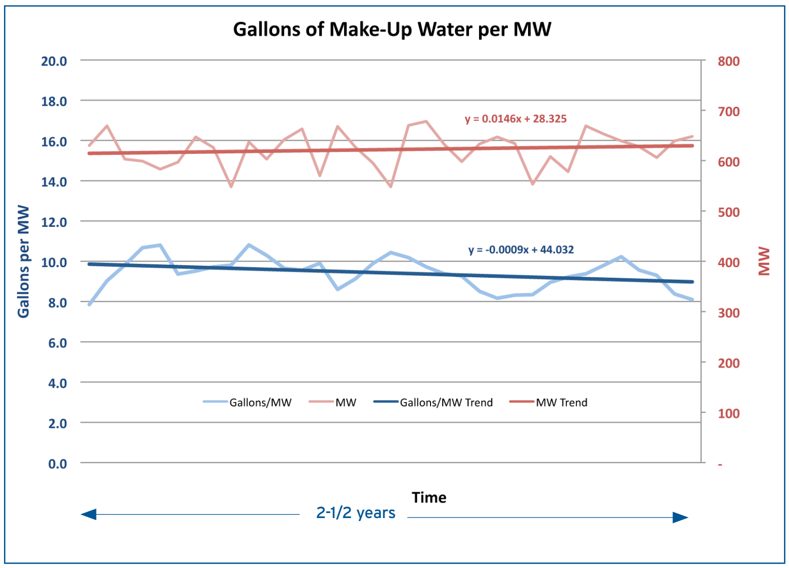

Figure 4 – *Plant load is not constant and make-up water demand is load dependent. This data shows average make-up water demand declining as load has increased slightly over time.*

In this case, technology and experience – the application of proven scientific principles and real-world operational expertise – provided a lasting benefit to OPPD and the residents of the Missouri River basin. By reducing their water withdrawal from the river, less stress is placed on the river system, less water is withdrawn from the reservoirs in the north and more water is available for agricultural and other uses.

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